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Purple bacteria and quantum Fourier transform SAMIR LIPOVACA — The LH-II of purple bacteria Rhodospirillum (Rs.) molischianum and Rhodopseudomonas (Rps.) acidophila adopts a highly symmetrical ring shape, with a radius of about 7 nm. In the case of Rps. acidophila the ring has a ninefold symmetry axis, and in LH-II from Rs. molischianum the ring has an eightfold symmetry axis. These rings are found to exibit two bands of excitons. A simplified mathematical description of the exciton states is given in Hu, X. & Schulten, K. (1997) Physics Today 50, 28-34. Using this description, we will show, by suitable labeling of the lowest energy (Qy) excited states of individual BChls, that the resulting exciton states are the quantum Fourier transform of the BChls excited states. For Rs. molischianum ring exciton states will be modeled as the four qubit quantum Fourier transform and the explicit circuit will be derived. Exciton states for Rps. acidophila ring cannot be modeled with an integer number of qubits. Both quantum Fourier transforms are instances of the hidden subgroup problem and this opens up a possibility that both purple bacteria implement an efficient quantum circuit for light harvesting.

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